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Original Research Paper

Decolorization of Reactive Dye Solutions by Electrocoagulation using Iron Electrodes

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ABSTRACT

The textile industry is facing major problems in the disposal of wastewater generated from textile dye and finishing processes. Textile dye wastewater has a strong colour, high COD, high total solids and is also biorefractory in nature. There is a need for most suitable and effective pretreatment technique. The present work focuses on the feasibility of electrocoagulation for the reactive dye solutions. The experiments were conducted for the optimized electrolysis duration at different applied currents and pH. The Study revealed that at a neutral pH there was a colour removal efficiency of 90% with minimum sludge production and anode consumption.

INTRODUCTION

Textile industry is one of the most polluting industries in terms of the volume and complexity of its effluent discharge. The dyeing and finishing operations in textile industries contribute a major share to wastewater generation (Mohan et al. 2001).

Dyes are organic colorants used in textile, pharmaceutical, cosmetic, food and other industries for imparting different shades of colours. Dye manufacturers and users, particularly the textile industries, release wastewaters in massive quantities containing dye to the extent of 0.001-0.7% (w/v), often with dissolved inorganic salts, dispersing agents, surfactants, and organics washed out from the materials. Reports also suggest that dye house effluents contain 0.1-2% (w/v) dye resulting in 2-9% of total global annual dye production, which is equivalent to nearly 50,000 tons. This situation will be further aggravated in the ensuing years as the demand for cotton and other fabric increases expo-nentially. The pH values of these discharges vary between 2 and 12, depending upon the dye and its application (Sanjay et al. 2005).

The pollution induced by dyestuff in the textile industry has been a serious environmental problem for years; dyes in the wastewater undergo chemical as well as biological changes, consume dissolved oxygen from the stream, and destroy aquatic life because of their toxicity. It is therefore necessary to treat the textile effluents prior to their discharge into the receiving water (Can et al. 2003).

Due to large variations in the effluent composition, most of these traditional methods are inadequate. Although the biological degradation is the most economic process, it is ineffective to degrade molecules of refractive nature. Though ozonation is quite effective for decolorization of textile wastewater, the biodegradability is difficult. The electrochemical methods appear to be effective for the treatment of different effluents compared to conventional methods. Above all, the electrochemical reactors are compact, simple and the rate of pollutant removal is very rapid (Muthukumar et al. 2007).

Most of electrochemical discoloration studies are focused on reactive dyes. They represent about 20-30% of the total market because of their solidity and brilliant colour. Their structure consists of a reactive group (which reacts with fibre) and a chromophore group (which gives the colour). The most used chromophore group is the azo (R-N=N-R') followed by anthraquinone group. Azo group constitute, more than half of worldwide production, approximately 65%. Moreover, this kind of dyes produces toxic aromatic products in their degradation. The high consumption of reactive dyes mainly in the cotton industry, increases this environmental and aesthetic problem, due to their low degree of exhaustion and their presence both in dyeing and soaping effluents (Mireia Sala et al. 2012).

A promising electrochemical process is by coagulation. Aluminium and iron sheets have been used as consumable